

BEDSIDE MEDICINE FOR BEDSIDE DOCTORS

An Open Forum for brief discussions of the workaday problems of the bedside doctor. Suggestions of subjects for discussions invited.

BONE TUMORS

I. SYMPTOMS AND DIAGNOSIS

GEORGE J. MCCHESENEY, M.D. (450 Sutter Street, San Francisco).—There is no more important and often difficult problem that may suddenly confront the general practitioner and specialist than the proper diagnosis of an abnormal bony mass. Usually a very careful history, use of laboratory aids and especially good x-rays will establish the nature of the tumor satisfactorily. This is not always the case, however. Osteomyelitis, tuberculosis, and syphilis may present masking symptoms which can cause considerable chagrin when the pathologist has made his report. Of even more importance is the question of malignancy with possible amputation of a limb. Here let me plead for the greater use of a biopsy in such doubtful and important cases. It has never been proved that such a procedure has disseminated a malignancy, or that cases so handled have metastasized more rapidly. With a properly done biopsy (and this means removal of an adequate amount of tissue, not a punch biopsy, with access to a skilled pathologist), one can do whatever is indicated with the feeling that all possible precautions have been taken. The pathologist is the court of last resort, but even he may have trouble in deciding upon certain varieties of sarcoma. As an additional precaution an x-ray treatment can be given before the biopsy and another afterward, if the pathologist's opinion is delayed while the specimen is being decalcified.

In bedside study and diagnosis, the all-important question is that of possible malignancy. The most practical way to answer this is to keep in mind the benign tumors and their symptoms. If the tumor can be classified under any one of them, while at the same time osteomyelitis, tuberculosis, syphilis, and even callus, following fracture, can be ruled out, the problem is solved.

Benign Tumors.—The most common benign tumors are:

1. Exostoses or osteochondromas, characterized by fairly constant age limit of ten to twenty-five years, lack of pain, location near ends of long bones, and attachment by a broad base or pedicle. The x-ray shows fairly normal bone structure.

2. Chondromas, occurring from twenty to thirty years, usually in phalanges of hands and feet, occasionally in ribs and sternum. In x-ray show as a central cyst with expanded cortices. Soreness is slight and growth gradual.

3. Bone cysts, usually between ages of ten to fifteen, rarely over twenty. Distribution is pretty constantly in upper halves of the humerus, femur and tibia in order of frequency. The cortex is expanded and thinned, with a resultant tendency to

pathologic fracture. Soreness is negligible and growth slow.

4. Giant cell sarcomas occur usually after thirty, grow faster with some pain, and may be related to trauma. They are most common in the epiphyses of long bones ending in knee and wrist joints, have a thin bony shell which is soon perforated.

Malignant Tumors.—Turning now to the malignant tumors, we have several forms of sarcomata, all with a very useful diagnostic clue, viz., periosteal changes in the x-ray. Primary chondrosarcomas occur at ages of fourteen to twenty-one, usually about the knees and with pain. Secondary chondrosarcomas occur in adults, about ribs and sternum, and are slow and painful. Sclerosing osteogenic sarcomas occur between the ages of fifteen and twenty-five, usually in the region of the knee, and run an acute, painful course. Osteolytic osteogenic sarcomas differ only in running a slower course. The main identifying characteristic is, as above, periosteal growth shown in x-ray.

One form of sarcoma, however, the so-called Ewing tumor, presents diagnostic difficulty in its resemblance to chronic forms of osteomyelitis. Both may have pain, fever, and leukocytosis in the same age groups. The x-ray is more helpful, especially as the tumor does not form an involucrum. Here biopsy may help, but must go deep enough to get the cells in the center of the tumor.

Multiple myelomata can be recognized by incidence after age of sixty, multiplicity, punched-out x-ray appearance, etc.

Metastases from carcinoma arise principally from disease of the prostate and breast. Hypernephroma is third in frequency. Pain is usually marked, fracture can be expected and involvement is most frequent in spine, pelvis, and femur. X-ray picture is essentially of a destructive character.

To give the differential diagnosis between these tumors and the familiar diseases of osteomyelitis, tuberculosis, and syphilis, is beyond the limit of this discussion; but if the cardinal and well-known symptoms of these diseases are kept in mind, their separation from the tumors is not usually difficult, except in the case of the Ewing sarcoma.

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II. PROGNOSIS AND TREATMENT

ROBERT L. CARROLL, M.D. (Orthopedic Hospital, Los Angeles). *Benign Types.*—Benign bone tumors are usually very slow-growing, and since they do not metastasize cause local trouble only. Without treatment they will probably enlarge some. Osteochondromas usually grow most during the rapid growth of bones in adolescence or even earlier, while other bone tumors may continue to grow in adult life.

Osteomas and osteochondromas may cause mechanical blocking of the near-by joint, or tendons may ride over them, causing a snapping sensation when they ride over the crest of the tumor, and in doing so may cause some pain. If discomfort is great, the mechanical obstruction should be removed by excision of the tumor. There is a moderate tendency to recurrence after excision, particularly in the osteochondromas; hence postoperative irradiation is advisable. Geschickter and Copeland report that 7 per cent of osteochondromas become malignant.

Although *endochondroma* is a benign tumor, the larger the tumor the more potentially malignant it becomes and is probably best treated by irradiation. The smaller ones are best treated by complete curettage of the tumor mass, but if too large for complete removal irradiation should follow the surgery, especially in the long bones—as the tibia—though they occur here rarely. There is a definite tendency to recurrence.

Bone cysts may increase in size until they begin to destroy the cortex of the bone enough to allow a pathological fracture, following which there may be a spontaneous cure. Bone cysts usually respond well to irradiation or curettage. If curettage is done it should be as complete as possible, and the cavity should be filled with bone chips. There is a moderate tendency to recurrence.

Considerable discussion has arisen, and there is voluminous literature concerning *giant cell tumors*. All agree that this tumor is essentially benign. Some dogmatically state that it is always so, whereas others equally dogmatically state that the viability and aggressiveness of the tumor cells may change toward the malignant type and may metastasize to the lungs though extremely rarely. Each side presents its arguments not without some justification, and it would seem logical to assume that a complete correct answer has not yet been found. The treatment of these tumors has changed considerably in the last few decades from radical to more conservative, and in place of amputation resections have given many good results. Then curettage of the tumor in the early stages was found to be satisfactory and did not leave the deformity that resection would cause, and now the treatments appear to lie between curettage and irradiation. Even though irradiation has not been accepted as the method of choice by all, it has given some good results. More time and study of these cases will doubtless eventually clear up some of the points not thoroughly understood at present. Without treatment they usually continue to grow, and sometimes with treatment. No one set rule can be given for treatment of all giant cell tumors. All the data must be considered before the decision is made. In many of the cases early irradiation will prove quite satisfactory. Also complete removal by curettage and filling the cavity with bone chips will usually give good results. There is approximately 20 per cent recurrence following curettage. If curettage is selected as the method of treatment, Kolodny states that it should be continued, even with recurrences, rather than change to irradiation, and that it is even better to amputate before chang-

ing from repeated curettage of the same tumor to irradiation of it, as there seems to be good reason to believe that the irritation from surgery, together with irradiation, may make the tumor cells more viable and aggressive, and the possibility of malignant change and metastasis becomes greater. When the tumors are found early, irradiation usually gives good results. If a tumor is seen for the first time in the advanced stage, complete removal may not be practicable; but even though it is considered a benign tumor, if amputation would give better practical results there is no reason why whatever method that will do so should not be used. Also, in the very large tumors, if they are curetted, there is the danger of hemorrhage which has been reported in some cases to be fatal. Also, if they are packed open, there is the danger of infection with subsequent osteomyelitis, and in such a case it can be clearly seen that an amputation, if this were about the ankle or the knee, and if the tumor were very large, may give a better practical result. With adequate treatment of the tumor in the early stage there should be a good prognosis.

Malignant Types.—Malignant bone tumors have a grave prognosis, although a few five-year cures have been reported. Usually the patient may live anywhere from a few weeks to a few years, depending upon the rapidity of the growth and the degree of malignancy of the tumor. It has been noted that the nearer the trunk the greater the degree of malignancy appears to be and, consequently, the worse the prognosis. Whenever the diagnosis is in question, the patient should have the advantage of irradiation until the diagnosis is established. Since the prognosis is grave, whatever makes the patient's remaining life most comfortable and most useful should be used. The first thing requiring attention usually is relief of pain, together with prevention of increased pain in the future, for which irradiation is desirable, as well as for the prevention of growth of the tumor. If it were possible to amputate before there are any metastases, this should affect a cure. Since it has been proved that metastasis to the lungs has occurred by the time the primary growth was discovered, although it was in so early a stage that it was barely discernible by x-ray, amputation should be approached, not with the idea of preventing metastasis entirely, but to relieve the patient of pain which may become almost unbearable with a rapidly growing tumor, some of which may become so vascular that prevention of ulceration and hemorrhage becomes a problem. Also, the foul discharge from such an ulcerating tumor mass would probably be more unpleasant than the sight of an amputated leg. Most surgeons experienced with malignant bone tumors in the lower extremities prefer amputation, and this should be done between two tourniquets, the proximal one for hemostasis, and the distal one to prevent a possible dislodgment of tumor cells into the blood stream. Even if biopsy is done, this precaution should be taken so that the amputation may be done if the pathology confirms the diagnosis. Some of the cases with least discomfort and most useful lives have been those of bone malignancy in the lower extremities, recog-

nized apparently in the extremely early stage with immediate amputation, and later satisfactory artificial leg, which allows the patient to regain satisfactory function of the lower extremity and live a useful, comfortable life for a while even though death may occur years later from pulmonary metastasis. Resections have been done at times, but are not as much in favor with our present advancement in prosthetic surgery as amputations. Disarticulations of the proximal joints has also been done with the hope of trying to avoid metastasis, but the end-results have been apparently no better than with amputation, even though the malignant tissue may involve the marrow cavity of the bone at site of amputation without being apparent in x-ray. Hence, amputation, preceded and followed by irradiation, for malignancies in the lower extremities, seems to give the best practical result. Amputations and disarticulations in the upper extremities have not proved as satisfactory as in the lower extremities. Here irradiation usually is the method of choice where it can be skillfully applied to alleviate the pain and retard the growth of the tumor. It is not without its disadvantages, however, because insufficient irradiation may stimulate the new growth, whereas too much irradiation is dangerous and may ankylose the near-by joint by sclerosing the soft parts. The psychic shock to the patient is probably greater in amputation of the upper extremities than in the lower. Malignancies of the trunk are best treated by irradiation.

Osteogenic sarcomas are more frequently found in children, and are usually more malignant and more rapid in growth than in adults, and their expectancy as to life is not so long. This seems logical when we remember that these tumors are most frequently seen in children, not only in areas where the growth is most intense, but also at an age when the growth is most rapid. Treatment is as outlined above.

Primary chondrosarcomas and chondromyxosarcomas are extremely malignant and amputation is the treatment of choice. In spite of the fact that these tumor cells are radiosensitive, irradiation seems to be of little benefit except as a palliative measure, again showing that radiosensitivity and curability are not synonymous terms. Such secondary tumors are much less malignant, and their growth is much less rapid. Hence, the prognosis is better for longer life, though treatment is as above.

Ewing's tumor or endothelioma has practically the same prognosis and requires the same treatment as osteogenic sarcoma, except that it responds very readily to irradiation; and if the average span of life is considered, the chances for longer life are better on an average with the former.

Myelomas seldom are amenable to surgery, since they rarely occur singly in areas readily accessible to surgery, hence irradiation is the method of choice. Some support, or even absence of weight bearing, may become necessary, particularly in involvement of the spine, to prevent pathological fractures and collapse. The average span of life is usually a little better with these cases than with osteogenic sarcomas.

Neurosarcomas and fibrosarcomas, though not bone tumors, may invade bone. The former is extremely malignant; the latter grows much less slowly, and should be treated as sarcoma.

Soft tissue tumors, metastasizing into bones, such as cancer, have to be considered largely in a palliative manner, as practically nothing from a therapeutic standpoint can be expected except alleviation of pain by irradiation, which may also give some restraint to the new growth. In the advanced stage complete recumbency may be necessary to prevent collapse, particularly of the involved vertebral bodies.

Summary.—Since benign bone tumors do not metastasize and cause local trouble only, usually in a mechanical way, excision of the tumor mass should give a good prognosis and relieve the local disturbance. Malignant bone tumors have a grave prognosis, and life's span, though definitely limited, may be unquestionably prolonged, and the patient made more comfortable, by adequate measures such as irradiation or amputation, especially in the lower extremities.

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III. X-RAY DIAGNOSIS OF BONE TUMORS

KENNETH S. DAVIS, M.D. (St. Vincent's Hospital, Los Angeles).—The demonstration of a bone tumor on the roentgenogram is usually easily done, but the interpretation of these findings in terms of pathology presents a good example of the limitations of the x-ray in diagnosis. It should always be remembered that the x-ray has no microscopic attachment.

In the roentgenological analysis of bone tumors certain x-ray findings should be given special consideration:

1. The location of the tumor.
2. The point of origin of the tumor—medullary canal, cortex, periosteum, metaphysis or epiphysis.
3. The condition of the bone cortex—thickened, thinned, expanded or destroyed.
4. Presence or absence of periosteal bone production.
5. The invasion of surrounding bone or soft tissues.
6. Is the tumor single or multiple?
7. The presence or absence of metastasis in other parts of the body.

Clinical and laboratory data of aid to the radiologist in the differential diagnosis of bone tumors:

1. The age of the patient (important).
2. Duration of symptoms. (This gives an index of the rapidity of growth of the tumor.)
3. History of trauma.
4. Pain. Unexplained pain in the region of a bone or joint, with or without history of trauma, should call for repeated x-rays at suitable intervals until a definite diagnosis has been made.
5. The size and appearance of the tumor on physical examination.
6. Loss of weight and strength.
7. Anemia.
8. The finding of the primary tumor in cases of suspected bone metastases.

9. Systemic reactions. Fever, leukocytosis, etc., are more apt to occur in the rapidly growing malignant tumors than in benign tumors.

10. Wassermann, especially useful in differentiating between Ewing's tumor and syphilis.

11. Other laboratory data, especially the hemoglobin, the white count, and the urine analysis for Bence Jones albuminuria.

12. Biopsy.

The differential diagnosis between primary benign and malignant bone tumors:

1. Benign tumors are sharply delimited and their borders are smooth, whereas the borders of malignant tumors are hazy and indistinct due to the fact that they infiltrate into the surrounding tissues.

2. Benign tumors which are medullary in origin are slow-growing, taking the path of least resistance, so that they tend to grow up and down the medullary canal rather than toward the cortex. This gives them an oval shape. Eventually they cause an expansion and thinning of the cortex which, however, is always intact.

In malignant tumors the tumor spreads by infiltrating and destroying the cortex instead of expanding it. Their shape is more or less spherical, as they grow equally in all directions.

3. Other findings, such as the presence of metastases in other parts of the body, rapidity of growth, etc., will aid the roentgenologist in the differentiation.

Exostoses.—Exostoses are not true bone tumors, but are simply an irregular extension of normal bone into the surrounding soft tissues. They are characterized by their slow development, by the fact that their structure is that of normal bone and that they blend into the bone at their point of origin, with no break in the continuity of the cancellous bone markings. They may appear in any part of the skeleton, but are most commonly found near the ends of long bones. They are divided into two general groups, depending on their shape: (1) the table top, which is broad and very dense; and (2) the pencil type, which is more or less elongated.

Osteochondroma.—A true bone tumor, containing variable amounts of bone and cartilage. These tumors are attached to the cortex by a pedicle and have a typical cauliflower shape. The typical tumor is sharply delimited, and shows no tendency to invade the surrounding soft tissues.

Multiple Cartilaginous Exostoses.—In this bone affection there is found multiple osteocartilaginous outgrowths from the ends of long bones and from the flat bones. It is probably due to a disturbance in the proliferation and ossification of the bone-forming cartilage. It is a hereditary affection.

Chondroma (Enchondroma).—Benign bone tumors; their origin probably being due to misplaced cartilage cells. They are both medullary and cortical in origin. They cause an irregular, asymmetrical enlargement of bone, are usually multiple, and are most common in the hands and feet. These tumors are less dense than normal bone, are circular-shaped and sharply delimited.

Bone Cysts.—Solitary bone cysts usually occur in the long bones and in the jaw. They are characterized by sharply defined, rounded or oval-shaped

areas of rarefaction which may or may not be trabeculated. The tumor is generally medullary in origin, causing a thinning and expansion of the cortex which, however, is always intact.

Cysts never occur in the epiphysis: an important differential point from giant cell tumors.

Solitary bone cysts are seldom due to hyperparathyroidism, but before the latter is definitely excluded other bones should be x-rayed.

Giant Cell Tumor.—A benign tumor, usually occurring as a central, single tumor in the ends of long bones, characterized on the roentgenogram by its asymmetrical spherical shape and its tendency to be located in the epiphysis. The cortex is markedly expanded, and in some instances may be perforated; but there is no invasion of the surrounding soft tissues. The tumor is of less density than the surrounding bone and is trabeculated. Its borders in most cases are sharply delimited.

Osteogenic Sarcoma.—Bone sarcoma is a rapidly growing, highly malignant bone tumor, appearing generally as a single lesion in the shaft of a long bone in a relatively young individual. The tumor metastasizes early, usually through the blood stream.

The Bone Tumor Registry recognizes several "anatomic" types of osteogenic sarcoma, although certain of these groups cannot be distinctly differentiated on the roentgenogram.

1. Osteolytic sarcoma: A destructive tumor arising in the region of the marrow cavity in the shaft of the long bones, characterized on the roentgenogram by a central, more or less spherical area of bone destruction, the tumor dissolving the bone cortex without expansion.

2. Sclerosing sarcoma: A type of osteogenic sarcoma characterized on the roentgenogram by the formation of dense new bone which obliterates the normal osseous markings. This is usually associated with periosteal new bone formation.

3. Periosteal osteogenic sarcoma: This subdivision is still recognized by the Bone Tumor Registry, although there are very few cases in which the periosteum is the only point of involvement. On the roentgenogram there is seen a tumor completely surrounding an intact bone shaft. The tumor remains encapsulated by the periosteum for some time. Erosion of the cortex occurs only in the later stages of the disease. The diagnostic feature is the presence of strands of osseous material radiating throughout the tumor at right angles to the shaft, producing a characteristic "sun ray" appearance.

4. The Undifferentiated type: Characterized by irregular patchy areas of bone destruction. This form closely simulates certain types of bone metastases.

Ewing's Tumor.—This tumor, as seen on the roentgenogram, is most often diffuse and situated near the mid-shaft region of a long bone. There is usually noted an expansion of the shaft with periosteal new bone formation, which in structure resembles onion peel. Later the cortex becomes thickened and shows an increase in its density. Ninety-five per cent of all reported cases are between four and twenty-five years of age.

The exact diagnosis in most of these tumors is seldom made without a biopsy.

Multiple Myeloma.—A rather uncommon form of primary bone tumor characterized by the presence of many foci in the bone marrow of adults. The ribs, skull, spine, pelvis, and the upper ends of the humerus and femur are sites of predilection. The typical roentgenographic findings consist in multiple, small areas of rarefaction which are circular in shape and usually sharply defined. As the disease progresses it becomes more and more similar to metastatic carcinoma in its appearance. Bence Jones albuminuria in the urine occurs in 60 per cent of these cases. In the skull there are often found multiple "punched out" circular-shaped areas, different in appearance from bone metastases.

Bone Metastases.—There are two types of metastases to bone recognizable on the roentgenogram:

Osteoclastic (osteolytic) metastases characterized by irregular multiple bone destruction, with a normal bone outline and no evidence of invasion of surrounding soft tissues.

The one exception is in the metastases from hypernephroma, in which invasion does occur.

Osteoplastic metastases: A form of metastasis of slow development, characterized by production of dense bone around the growth. This type is usually primary in prostatic carcinoma. The bones most commonly involved are the pelvis, sacrum, and lumbar spine.

"Sight Begins at Forty."—Properly cared for, the eyes of the middle-aged may be as efficient as they ever were in youth. Dr. Ellice M. Algar points out in an article entitled "Sight Begins at Forty," published in *The Sight-Saving Review*, quarterly journal of the National Society for the Prevention of Blindness. Doctor Algar is professor of ophthalmology at the New York Postgraduate Medical School and the winner of the 1938 Leslie Dana Gold Medal for his lifelong work for the prevention of blindness and the conservation of vision.

"Most people enter the period of middle life with a feeling of profound discouragement," says Doctor Algar. "They are increasingly conscious that they can no longer do things as well or as easily as they once did, and the joy of accomplishment has gone out of them. Ambitions have failed of realization or have proved disappointing. Health itself, instead of being effortless and automatic, requires a conscious or subconscious attention that it never did before."

"One of the most discouraging things about the whole period is the gradual failure of the eyes, which are a very essential factor in a contented and useful middle age. For age brings its own eye problems quite different from those of youth. The eyes tire sooner than they did and vision is not so automatically clear. The acute inflammations and infections are not so common as in youth, but they have a greater tendency to become chronic."

"But the picture is not by any means as drab as it seems. As a matter of fact, much can be done to mitigate these discomforts and postpone these changes and cure these diseases. Properly cared for, the eyes of the elderly are often more efficient and less troublesome than they ever were in youth."

"The young child has the keenest of distance vision and at the same time he can thread a tiny needle or read the finest print held within three or four inches of the eyes. He can do this because he has a lens in his eye as clear as crystal and as elastic as live rubber, so that it adjusts to near or far vision without effort. As he gets older the lens remains transparent, but it becomes more and more inelastic. He still sees perfectly at a distance, but his near point recedes steadily."

"By the time he is forty-five he can just about read fine print. He begins to hold his book farther away than is comfortable, and laughingly says that his eyes are all right but his arms are too short. He requires stronger and stronger light. If he is compelled to use his eyes too much, they get tired—he goes to sleep over his book and blames his dinner; or he gets an eyache or a headache. There is a long list of aches and pains that follow the forcing of tired eyes."

"To this universal physiological inability of the aging eyes to focus, we give the name 'presbyopia,' or 'old sight.' Ordinarily it begins some time in the early forties, but if one is farsighted or astigmatic, it comes earlier. If one is nearsighted it may not come at all. The eyes of the farmer, or the sailor, or laborer, with little near work to do, may function efficiently long after forty; while ill health or overwork brings it on much earlier."

"But sooner or later most of us have to wear convex glasses which 'magnify' the print and bring it 'nearer' and, in doing so, make near vision sharp, without fatigue. If one is farsighted or astigmatic, the presbyopic correction must be added to that of the distance. There are many persons, especially ladies, who are quite determined that so long as they show no other indication of advancing age they are certainly not going to admit it by wearing glasses. Each year sees a new crop of lotions, drops, tonics, and reading lamps advertised as substitutes for glasses, which are sold to these people."

"One of the great compensations for the onset of 'old sight' is that it results or should result in a complete and careful examination of the eyes, perhaps the first the patient has ever had. There should be a lot more to it than the mere examination for glasses, for the list of diseases that commonly occur in aging eyes is a rather long one. Some of them are rare and some of them very common; some are trivial and self-limited, others are painful and tend to get worse. Some of them threaten sight alone, while a few threaten life itself."

"There is no argument that applies to the annual physical examination of the body which does not apply with equal force to the eyes. The only person who is competent to make this kind of an examination is the eye physician. He has been trained to know and treat diseases whether they involve the eyes alone or the body behind the eyes. His work overlaps on many other specialties. He must have a knowledge of eugenics, pediatrics, neurology, and general medicine. He must always have in mind syphilis, tuberculosis, the toxemias, and the focal infections, and even the various tumors."

"When the sight begins to fail the thing that the average adult dreads more than anything is cataract. He has seen it among his elders, and fears the impairment of vision and perhaps an unsuccessful operation at the end. Many people are as depressed about cataracts as they would be about cancer. And yet in many cases it is not such a terrible thing. It is not necessarily conspicuous and, unless complicated in some way, it is never painful. It occurs in many forms, some due to disease like diabetes or to accident; but for the most part it is the result of perfectly natural senile opacities in the crystalline lens. One of the first things to arouse the physician's suspicion is that, in the beginning, the lens, while still perfectly transparent, swells and makes the patient nearsighted. He often finds that he can again read without glasses, and is very proud of his so-called 'second sight.'"

"Perhaps the most serious of eye diseases which threaten people as they grow older is glaucoma. While it is not nearly so common as cataract, it is much more difficult to recognize in its beginning, and it often results in complete blindness in spite of the most careful treatment."

"A careful routine examination of the eyes by one who knows how often reveals unsuspected conditions, like Bright's disease, diabetes, brain tumor, or locomotor ataxia, while there is still time to do something about them—before sight has been irretrievably damaged or the possibility of recovery gone forever."

There is always a certain amount of communicable disease lurking in a community; thus disaster conditions such as recently occurred in the midwestern flooded area throw the door wide open for its spread.